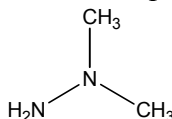


## 1,1-DIMETHYLHYDRAZINE

CAS No. 57-14-7

First Listed in the *Fourth Annual Report on Carcinogens*



### CARCINOGENICITY

1,1-Dimethylhydrazine (unsymmetrical dimethylhydrazine; UDMH) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (IARC V.4, 1974; IARC S.4, 1982). When administered by gavage, 1,1-dimethylhydrazine increased the incidence of lung tumors in female mice. When administered in the drinking water, 1,1-dimethylhydrazine induced high incidences of angiosarcomas in various organs and tumors of the kidneys, lungs, and liver in mice of both sexes. The same route of administration induced liver carcinomas in rats.

There are no adequate data available to evaluate the carcinogenicity of 1,1-dimethylhydrazine in humans (IARC V.4, 1974).

### PROPERTIES

1,1-Dimethylhydrazine is a clear, colorless, flammable, hygroscopic liquid with an ammonia-like, fishy odor. 1,1-Dimethylhydrazine is miscible with water, ethanol, ether, dimethylformamide, and hydrocarbons. The liquid fumes in air and gradually turns yellow. Its vapor is inflammable in air but ignites spontaneously when in contact with heat, flame, or oxidizers. When heated to decomposition, it emits toxic fumes of nitrogen oxides (NO<sub>x</sub>). 1,1-Dimethylhydrazine has been available in the United States as a single grade containing 98% (minimum) active ingredient with 1.9% (maximum) dimethylamine and 0.3% (maximum) water content.

### USE

The primary use of 1,1-dimethylhydrazine has been as a storable, high-energy propellant for liquid-fueled rockets. Significant quantities of 1,1-dimethylhydrazine were used in the manufacture of *N*-dimethylaminosuccinamic acid, a plant growth regulator. 1,1-Dimethylhydrazine has also been used in the control of vegetation, flowers, or fruits of such crops as apples, grapes, peanuts, cherries, peaches, and tomatoes (IARC V.4, 1974). 1,1-Dimethylhydrazine was used as a chemical intermediate in the production of aminimides on a pilot-plant scale in 1973. It is still used as an intermediate for organic chemical synthesis, as well as an adsorbent for acid gases and in photography (ATSDR, 1997-R055).

## PRODUCTION

Information on current production volumes for 1,1-dimethylhydrazine and data on past or current import or export quantities are not publicly available (ATSDR, 1997-R055). The 1998 *Chemical Buyers Directory* lists one current U.S. supplier of the chemical, and the 1997 *Directory of Chemical Producers* identifies one producer (Tilton, 1997; SRIa, 1997). The former number is a marked decrease from the 18 suppliers of 1,1-dimethylhydrazine identified in 1989 and 1990 (Chem Sources, 1990, 1991). The USITC identified one commercial producer of 1,1-dimethylhydrazine from 1983 to 1986 (USITC, 1987). The Chem Sources USA directory identified eight producers of 1,1-dimethylhydrazine in 1986 (Chem Sources, 1986). The most recent production volume reported for the chemical was estimated to be more than 9,900 lb in 1982, and the most recent production capacity was estimated to be 30 million lb in 1984 (ATSDR, 1997-R055). The 1979 TSCA Inventory identified four companies that produced 55,000 lb of 1,1-dimethylhydrazine in 1977. The CBI Aggregate was between 1 million and 100 million lb (TSCA, 1979). Production of 1,1-dimethylhydrazine was first reported to the U.S. Tariff Commission in 1956 (IARC V.4, 1974).

## EXPOSURE

The primary routes of potential human exposure to 1,1-dimethylhydrazine are inhalation, ingestion, and dermal contact. Possible human exposure may occur during its production and use as a chemical intermediate or when applied to control the growth of crops and vegetation. Potential exposure by ingestion may occur if residues are present on foods treated with 1,1-dimethylhydrazine. For the general population, exposure to 1,1-dimethylhydrazine is expected to be very low due to its rapid environmental degradation; it has not been detected in air, water, or soil (ATSDR, 1997-R055).

Small amounts of 1,1-dimethylhydrazine (up to 147 ng/g) have been found in tobacco products; therefore, people who chew tobacco, smoke cigarettes, or are exposed to cigarette smoke indirectly may be exposed to small amounts of 1,1-dimethylhydrazine. In the past, humans have been exposed to 1,1-dimethylhydrazine following ingestion of fruits sprayed with the plant growth regulator Alar<sup>®</sup> (daminozide [1596-84-5]). Alar<sup>®</sup> is no longer used on food plants in the United States. However, it is still used on some non-food plants. Therefore, greenhouse workers who use Alar<sup>®</sup> may be exposed to small amounts of 1,1-dimethylhydrazine (ATSDR, 1997-R055).

The potential for high exposures to 1,1-dimethylhydrazine exist for those living near a military installation using the chemical or near hazardous waste sites contaminated with hydrazines and those exposed occupationally. In the workplace, exposure to 1,1-dimethylhydrazine may occur during its production, transportation, or use, especially if proper protective equipment is not used (ATSDR, 1997-R055). The National Occupational Exposure Survey (1981-1983) indicated that 2,917 workers were potentially exposed to 1,1-dimethylhydrazine (NIOSH, 1984). This estimate was based only on observations of the actual use of the compound. The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 16 people were potentially exposed to 1,1-dimethylhydrazine as a decomposition product in the workplace (NIOSH, 1976). The Toxic Chemical Release Inventory (EPA) listed four industrial facilities that produced, processed, or otherwise used 1,1-dimethylhydrazine in 1988 (TRI, 1990). In compliance with the Community Right-to-Know Program, the facilities reported releases of 1,1-dimethylhydrazine to the environment which were estimated to total 4,300 lb. According to the TRI published in 1995, 194 lb of the compound, amounting to 100% of the total environmental releases, were discharged to the air from facilities

in the United States in 1993; this release was mainly from its use as an aerospace propellant (ATSDR, 1997-R055).

## **REGULATIONS**

EPA regulates 1,1-dimethylhydrazine under the Clean Air Act (CAA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and Superfund Amendments and Reauthorization Act (SARA). The National Emission Standards for Hazardous Air Pollutants (NESHAP) addresses 1,1-dimethylhydrazine emissions from processing facilities under CAA. A reportable quantity (RQ) of 10 lb has been established for this chemical under CERCLA. 1,1-Dimethylhydrazine is subject to reporting requirements under RCRA and SARA. NIOSH recommends an exposure limit of 0.06 ppm (0.15 mg/m<sup>3</sup>) ceiling concentration (120-minute). OSHA established a permissible exposure limit (PEL) for this compound of 0.5 ppm as an 8-hr time-weighted average (TWA). OSHA also regulates 1,1-dimethylhydrazine under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table B-53.